Accessibility 2.0: People, Policies and Processes

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ABSTRACT

The work of the Web Accessibility Initiative (WAI) is described in a set of technical guidelines designed to maximise accessibility to digital resources. Further activities continue to focus on technical developments, with current discussions exploring the potential merits of use of Semantic Web and Web 2.0 approaches. In this paper we argue that the focus on technologies can be counter-productive. Rather than seeking to enhance accessibility through technical innovations, the authors argue that the priority should be for a user-focussed approach, which embeds best practices through the development of achievable policies and processes and which includes all stakeholders in the process of maximising accessibility.

The paper reviews previous work in this area and summarises criticisms of WAI's approach. The paper further develops a tangram model which describes a pluralistic, as opposed to a universal, approach to Web accessibility, which encourages creativity and diversity in developing accessible services. Such diversity will need to reflect the context of usage, including the aims of a service (informational, educational, cultural, etc.), the users' and the services providers' environment.

The paper describes a stakeholder approach to embedding best practices, which recognises that organisations will encounter difficulties in developing sustainable approaches by addressing only the needs of the end user and the Web developer. The paper describes work which has informed the ideas in this paper and plans for further work, including an approach to advocacy and education which coins the "Accessibility 2.0" term to describe a renewed approach to accessibility, which builds on previous work but prioritises the importance of the user. The paper concludes by describing the implications of the ideas described in this paper for WAI and for accessibility practitioner stakeholders.

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Web accessibility, people with disabilities, WAI, WCAG, guidelines, methodologies, contextual design.

1. THE WAI MODEL

As the body responsible for the coordination of developments to Web standards, the World Wide Web Consortium (W3C) has taken a lead in promoting accessibility of the Web for disabled people, not only as Web users, but also as Web authors. Since 1997, the W3C's Web Accessibility Initiative (WAI) has been extremely active and very successful both in raising awareness of the importance of Web accessibility and in developing a model which can help organisations to develop accessible Web resources. WAI promotes a tripartite model of accessibility, with the goal of universal Web accessibility in theory provided by full conformance with each of three components [9]. Of particular relevance to developers of Web resources is the Web Content Accessibility Guidelines (WCAG) [39]. WAI has been successful in promoting the WCAG around the world; the guidelines have been adopted by many organisations and are increasingly being adopted at a national level [42].

In the WAI model, the WCAG is coupled with accessibility guidelines for browsing and access technologies (the User Agent Accessibility Guidelines, UAAG [41]) and for tools to support creation of Web content (Authoring Tools Accessibility Guidelines, ATAG [40]), complemented by the activities of the Education and Outreach Working Group (EOWG) [46] and the Protocol and Formats Working Group (PFGW) [44]. This approach acknowledges that in addition to providers of Web content, developers of authoring tools and of browsers, media players and access technologies also have responsibility towards the provision of accessible Web content.

2. LIMITATIONS OF WAI'S APPROACH

2.1 Shortcomings of the WAI Model

Although WAI has been very successful at a political level, and to a large extent at a technical level, the authors feel that the model of Web accessibility adopted by WAI is flawed. This is due partly to the nature of the WCAG and also to the overwhelming domination of the role of WCAG with respect to the other guidelines in the accessibility of online information and services. The WAI model relies on conformance with each of the three sets of guidelines –WCAG for content, ATAG for the tools used to create the content, and UAAG for the tools used to access that content. While Web authors have control over how well they conform with WCAG, and to a lesser extent ATAG, they have no control over how users access content. This leaves an awkward situation whereby users may not benefit from the accessibility features promised by a WCAG conformant Web page, due to their choice of browsing or assistive technology.

2.2 Shortcomings of WCAG

Shortcomings of version 1.0 of WCAG have been documented elsewhere by the authors [16]. In theory, these shortcomings should be of limited impact given that work has for several years been ongoing on WCAG 2.0, the replacement for WCAG 1.0, since 2001.

WCAG 2.0 represents a fundamental departure from the approach to accessibility taken by the May 1999 WCAG 1.0 recommendation. In comparison to the HTML-focused WCAG 1.0, WCAG 2.0, on the other hand, is fundamentally "technology-agnostic". Its core principles (POUR: perceivable, operable, understandable, robust), guidelines and related 'success criteria' aim to be applicable to the widest possible range of present and future technologies used to deliver content on the Web – including non-W3C technologies. The normative guidelines are meant to be complemented by non-normative, technology-specific 'techniques' documents, detailing specific implementation examples and best practices.

The call for review of the WCAG 2.0 Last Call Working Draft was issued in April 2006. This was received in many expert circles with reactions ranging "between the lukewarm and the outright hostile" [22]. In an article that brought WCAG 2.0 to the attention of the wider Web design community, Clark [10] raised (among other issues) fundamental concerns regarding:

- The size of the documentation (normative and non-normative), which, it is argued, will negatively impact adoption by actual designers and developers.
- Its inscrutable language: due to WCAG 2.0's aim to be technologically neutral, the language used for guidelines and success criteria is generic, comprised of vague new terms and definitions.
- The potential for abuse inherent in the concepts of baselines and scoping as a means to justify inaccessible sections of a site and proprietary technologies which present accessibility hurdles to users.
- The omission of markup validation / standards-compliance from the guidelines.
- Lack of adequate provision for users with cognitive disabilities and learning difficulties.

On this last point, Seeman submitted a formal objection to WCAG 2.0, requesting that implicit claims that the guidelines do cover cognitive disabilities be omitted from the guidelines' abstract altogether [32].

Almost a year after the original call for review, WAI is still working towards addressing issues and comments raised during the review period. It hopes to issue updated documents in early 2007, with a view to finalising the guidelines by the end of the year [43] but whether this deadline will be achieved and whether the guidelines will be approved by W3C member organisations remains to be seen. Indeed, the presence of work led by Clark, but unaffiliated to W3C, to concentrate on providing "corrections for, and extensions to WCAG 1.0" [46] indicate a lack of faith many Web developers have in WCAG 2.0 which recently culminated in an open letter by Clark to Tim Berners-Lee [11], calling for the new version of the guidelines to be canceled.

3. MEASURING ACCESSIBILITY: EVIDENCE-BASED ACCESSIBILITY

WAI defines Web accessibility as meaning that "people with disabilities can use the Web … more specifically [they] can perceive, understand, navigate, and interact with the Web" [14]. However, as discussed above, it strongly advocates measuring accessibility by conformance to accessibility guidelines, particularly WCAG. Yet this leaves a gap in the logic of how to ensure accessibility – what is the evidence that following the guidelines will create resources that people with disabilities can perceive, understand, navigate and interact with? This evidence is surprisingly lacking. The investigation conducted for the Disability Rights Commission [13] found no relationship between the number of violations of accessibility guidelines and either objective or subjective measures disabled people's ability to use 100 Web sites. As part of a similar investigation for the Museums, Libraries and Archives Council [22] a study of the accessibility of a sample of international museum Web sites found the museum Web site with the highest conformance to WCAG was the one disabled users found most difficult to use.

There is a similar lack of evidence for the basis of the three priority levels used in WCAG which make specific claims about the number of groups of disabled users and the problems of accessibility if guidelines of particular priorities are violated. A user-based study with blind Web users recently found that there was no relationship between users ratings of problems they encountered and the priority levels associated with these problems [23]. There is an urgent need for more investigations of evidence for the relationship between accessibility as measured by user behaviour and by conformance to guidelines.

Not only is there a need for evidence to support WAI guidelines, there is also a need for an evidence-based approach to accessibility as we move forward to WCAG 2.0. A useful model in this regard is the set of guidelines for Web usability compiled by the US Department of Health and Human Services [12]. Each guideline in this set is accompanied by a rating of its importance in creating usable Web resources and a rating of its "strength of evidence". The methodology for producing these ratings and all the research used in calculating them is provided in the documentation. This transparent approach would be extremely useful for developing measures of accessibility. Unfortunately one critical problem is the lack of empirical research on the details of accessibility to draw on in developing such measures.

4. THE ROLE OF CONTEXT

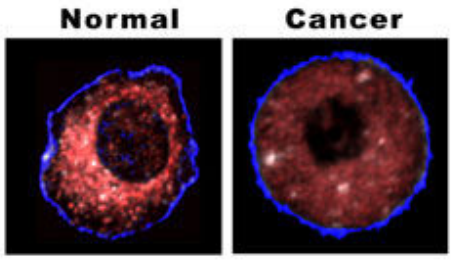
WCAG aims to support Web authors in making content as accessible and usable to disabled people as possible. The overarching purpose of the guidelines is impeccable but the way they are expressed does not take account of variations in the context of use. They work best where the information design task is one of simple presentation, such as in the case of a novel, company accounts, train timetables, self-assembly instructions and so on, where the role of the user is simply to apprehend the information. But there are contexts where the user role extends beyond simple apprehension to include, for example, analysis and interpretation. This becomes a major challenge when interpreting and applying WCAG in, for example, a cultural or artistic context or a teaching and learning environment. Consider **Figure 1**. What can you see?

Figure 1: What is this?

(Reproduced with permission from http://www.seabury.edu/faculty/akma/duckrab.gif)

Figure 1 is a typical gestalt- style image that at times looks like a duck and at other times a rabbit. It does not morph gradually from one to the other but seems to transform instantaneously. WCAG checkpoint 1.1 exhorts designers to provide a text equivalent for every non-text element to accommodate those with visual impairment. What would that mean in this instance? A text that described the image as either a duck or a rabbit would be misleading. To describe it as an image that looks like both a duck and a rabbit is probably not very helpful and immediately gives the game away. The whole point of the picture is to let the viewer experience each of these competing images for themselves. The idea of providing an alternative but equivalent experience is based on sound logic, but the requirement to provide a text alternative is probably inappropriate in this instance. It may be possible to create an equivalent sensation by offering a sound that can be interpreted in more than one way. Or it may be that we have to accept that in the Web environment there are occasions when there is no alternative equivalent experience and that some other medium, a tactile model for example, is required to supplement the digital information.

Figure 2: Normal and Cancerous Cells



(Reproduced with permission from http://www.sandia.gov/news-center/news-releases/2005/images/mitopic_nr.jpg)

The duck/rabbit image is arguably a special case, relevant perhaps largely within the domain of visual perception. But ambiguity and interpretation are distinguishing characteristics of most learning contexts beyond simple rote learning. While there will be occasions when it is important to convey information unambiguously (for example **Figure 2** shows what a healthy cell looks like compared with a cancerous cell), at other times it will be important to be less explicit (can the learner tell if another, different, cell is cancerous?).

While a significant proportion of learning is factual, it is widely recognised that knowledge is not simply transmitted from one party to another. It is constructed by the learner through some process of interaction with the information [6]. In some fields, such as the arts and humanities, personal perspective plays an important role in the learning process. Take the example of the image in **Figure 3**.

Figure 3: What Does This Convey?

(Man against snow, Austrian Tirol 1974, reproduced with permission of the photographer: Professor Paul Hill)

It is easy enough to provide a text description of what the picture shows factually: a figure in a dark coat walking beside a snowy bank. It is much harder to convey what the picture means. There may be as many interpretations as there are viewers, depending on their perspectives and motives for examining the picture: artist? historian? fashion designer? How does **Figure 3** make you feel? What would it like to be walking behind this person? Can you imagine being this person? A text alternative would be hard pressed to reproduce the ambiguity and ambience of such an image.

These simple examples have big implications for the way we think about accessibility in the context of learning. Clearly, it is a mistake to slavishly follow the guidelines; and therefore a mistake to mandate adherence to guidelines **if** the guidelines do not support contextual application as would be required in the examples above. We need to think about the problem from the perspective of the user. What are they likely to want or need to be able to do? And how can we best provide for those needs? Can we encapsulate this advice in guidelines, or do we have to enable learning by example?

In other words, we need to take a more holistic view, focusing on the accessibility of the learning or cultural experience in totality rather than merely thinking about the accessibility of the information resources in isolation. From this perspective the WAI's argument on "Why Standards Harmonization is Essential to Web Accessibility" [44] can be counter-productive: the application of harmonised standards may be desirable if other factors are equal, but not if this approach overrides the contextual aspects illustrated in this section.

5. A HOLISTIC APPROACH

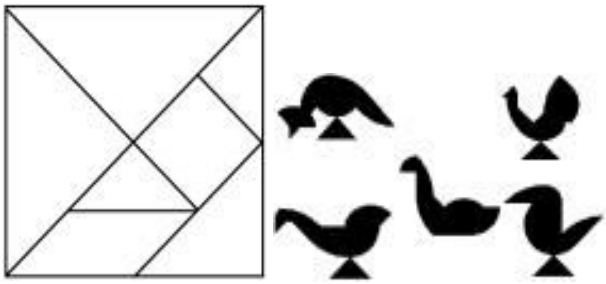
5.1 A Holistic Model for E-learning Accessibility

We have described a holistic approach to e-learning accessibility previously [17], [33]. This holistic approach sought to address the limitations of the WAI approach and to address the need to address the accessibility of the learning outcomes, rather than focusing on the accessibility of the e-learning resources. It recognises that other contextual aspects also need to be addressed, including pedagogical issues, available resources, organisation culture, and usability, as discussed previously). This holistic approach focuses on the accessibility of the outcomes of a service, departing from the traditional approach which addresses the accessibility of the service itself. The change in the emphasis from the creator of Web resources to the end user surfaces another tension: the context of use of the resource. The traditional approach has been to follow WCAG guidelines for the Web resource, in isolation of the use of the resource. Inverting this approach can lead to greater challenges for the Web developer, who will need to gain an understanding of the way in which the service is to be used and the wider issue related to its intended purpose.

5.2 The Tangram Model

In addressing the limitations of applying the WAI model for Web accessibility within the context of e-learning, exploring a holistic approach to e-learning accessibility led to the development of a Tangram metaphor [33] Here, the .metaphor implies an extensible, multi-component solution to accessibility that will vary depending on situation: as well as WAI guidelines, other guidelines may also be used, such as Nielsen's usability heuristics [20], guidelines for design for specific user groups, such as older people [18] or guidelines on clarity of written content [37].

Figure 4: The Tangram Model for Web development



The aim of this approach is to provide a solution which maximises the usefulness to the end user, as opposed to the current WAI approach which encourages mandatory application of a limited set of guidelines. The metaphor is meant to clarify that the most appropriate solutions can be obtained by engaging with the users rather than simply applying a set of rules.

We can see several advantages in the application of this model:

- The model can be extensible (we can make use of additional 'pieces'). This allows the approach to be extended as, for example, new technologies become available (e.g. guidelines for use of accessible Macromedia Flash or PDF can be incorporated).
- The model can cover general IT accessibility and is not limited to Web accessibility. This is particularly valuable given the accessibility implications of the anticipated convergence of Web and broadcast media, and resultant changes in access and delivery methods [7]
- The model can be extended to include real world solutions instead of constricting usage to poorly supported or commercially impractical technologies.
- The model can be extended to include Web accessibility issues which are not covered in WCAG (e.g. the accessibility of hard copy output of Web pages).
- The model is well-suited for use with Web resources which are personalised though use of accessibility metadata such as IMS Accessibility Metadata [33] (the model emphasises the service provided to the end user rather than individual components).
- The model can be deployed across different legal systems.
- The model is neutral regarding technologies.

6. A STAKEHOLDER MODEL

6.1 Developing a Stakeholder Model of Accessibility

A parallel activity in attempting to address the problem of a fixation by accessibility practitioners on 'compliance' with some form of accessibility 'rules' (often WCAG) has resulted in the development of the Stakeholder Model of Accessibility. This was driven by the need to expand thinking beyond that of how to comply with rules, towards how to meet the needs of disabled people, within the local contexts that users and their support workers are operating. This work has resulted in a contextualised model of accessibility practice, drawn from the context of higher education [30], [31]. This contextualised model of accessible e-learning practice in higher education takes into account:

- All the stakeholders of accessibility within a higher education institution.
- The context in which these stakeholders have to operate: drivers and mediators.
- How the relationship between the stakeholders and the context influences the responses they make and the accessible e-learning practices that develop (see **Figure 5**).

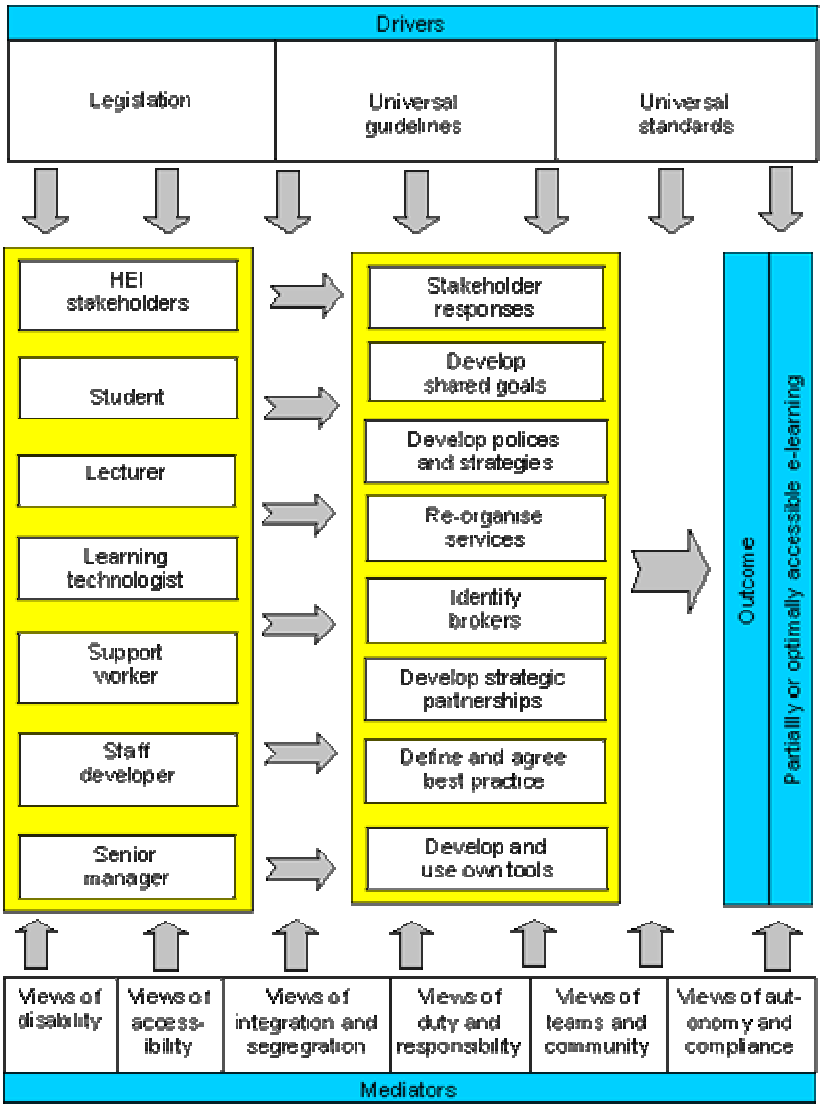
The extent to which e-learning material and resources are accessible will therefore be influenced by how all the stakeholders within a higher education institution respond to external drivers for accessibility such as legislation, guidelines and standards. In addition, however, this response will be mediated by stakeholders views and understandings of a range of issues including: disability, accessibility and inclusion; the extent to which they view themselves to have a duty and responsibility to respond; the extent to which they feel their personal autonomy is threatened and the extent to which they feel it is necessary or beneficial to respond as a community or team. The accessible e-learning practices that develop out of these responses will therefore vary depending on the stakeholders and the context in which they are operating but essentially centres on taking ownership and control as well as developing personal meaning (i.e. personal interpretations of the drivers of accessibility, depending on personal experiences and understandings).

A central argument that underpins this model is that accessible e-learning practice will not develop through the actions of individual practitioners or stakeholders. Accessible e-learning practice will develop and progress when all the different stakeholders join to work together. The key stakeholders in the development of accessible e-learning within a higher education institution can be identified as: lecturers, learning technologists, student support services, staff developers and senior managers and of course disabled students (users).

The importance of including disabled students as stakeholders of accessibility can be seen when we consider the results of a number of studies that have evaluated the accessibility of university main Web sites and found evidence of inaccessibility and failure to comply with WCAG 1.0 guidelines [3], [36] and [48]. Without a user-focused or stakeholder approach to accessibility the obvious response to such results would be to continue pointing to guidelines (this has not necessarily worked for WCAG 1.0, why should we assume it will work for WCAG 2.0?) or to place our hopes in new technologies such as Web 2.0 (why should we assume that Web 2.0 technologies will succeed where hundreds of accessibility focused technologies such as repair and filter tools have had limited success?).

We propose therefore that a more fruitful response would be to explore in more depth the students' experiences of e-learning and accessibility and the role that other stakeholders can play in helping to bridge any gap that exists between students and their online learning experiences. In other words, we should stop focusing solely on the drivers of accessibility and turn our attentions instead to the mediators of accessibility.

Figure 5: A contextualised model of accessible e-learning practice in Higher Education



6.2 Combining the Tangram and Stakeholder Models

There are synergies and overlaps between the two models of accessibility described in **Sections 5** and **6**. At the heart of both models are concepts of flexibility, contextualisation and user-involvement. Both models are underpinned by the argument that good design will be mediated by more factors than just a single set of guidelines.

The accessibility community has tools (legislation, guidelines, standard and policies) but what it lacks is an agreed "way of doing things"- an agreed way of using these tools. The Tangram and Stakeholder models of accessibility have been developed to offer a way forward from this stalemate position, by prompting us to move from trying to find "one best way" towards finding a "range of acceptable ways" that can be adapted to suit different purposes and contexts.

7. APPLICATION IN THE REAL WORLD

We have described a richer underlying framework for accessibility which is based on the Tangram and Stakeholder model. Application of this approach will require a wider framework of activities, including further advice and support for a wide range of stakeholders, extending involvement from just Web developers and policy makers as described in our previous work. Accessibility researchers should also look to how their work can support a contextual approach to accessibility.

In the UK and elsewhere, a philosophy of contextual accessibility can already be seen to be influencing a range of sectors in the way accessibility is considered in design. Some examples are given below.

7.1 E-Learning Examples

The contextualised model described in **Figure 5** offers seven examples of stakeholder responses to both the drivers and mediators of accessibility: identify brokers; develop strategic partnerships; define and agree best practice; develop shared goals; develop policies and strategies; re-organise services and develop and use own tools. Accessibility drivers and mediators can influence these responses in many different ways.

A classic response within Higher Education has been to develop and use contextualised tools and, in particular, contextualised guidelines.

The development of these tools has involved a range of different stakeholder operating at different levels, with different motivations. At the manager or macro level, examples of contextualised guidelines include:

- The Chancellor's Office of California Community Colleges [8] access guidelines for distance educators working with students with disabilities considered a range of delivery media including print, audio and video conferencing as well as the Web.
- The Australian Vice Chancellor's Committee's [4] 'Guidelines on Information Access for Students with Disabilities' are presented as advice on good practice, with the aim of assisting individual institutions to meet the needs of students with print disabilities through strategies and arrangements which are appropriate to their local circumstances.

A more global set of guidelines designed to cover education is that produced by the IMS Global Learning Consortium [11]. The Consortium recognises that other guidelines exist but argue that they are offering specific guidelines for areas that these guidelines do not cover (e.g. specific guidelines for subjects such as Maths and Music).

At the teacher- or meso-level, examples of contextualised guidelines include those that refer to education specific technologies such as Virtual Learning Environments [21]. The ALERT Project [2] offers a set of guidelines for using Virtual Learning Environments that will enable disabled learners to meet the pedagogical objectives that underpin the use of the VLEs. These guidelines are based on detailed interviews with disabled students and consider a range of teaching and learning activities such as discussions and assessments.

At the learner or micro level, examples of contextualised guidelines include guidelines to cater for specific disabilities that disabled learners have, for example learners with dyslexia [27]. For example, Powell *et al* [25] analysed both generic and dyslexia specific guidelines and drew out twelve recurrent themes, which they distilled into guidelines for designing e-learning material for dyslexic students.

The development of such local or contextualised guidelines could be viewed with alarm, in terms of the potential confusion that could be caused in relation to WCAG and a perceived need for standardisation. On the other hand, these developments could be viewed quite positively in terms of developing appropriate responses based on users needs as well as developing responses that are meaningful within the contexts that they are being used.

7.2 Institutional Repositories Example

A recent discussion on the digital-repositories JISCMail list [1] revealed some of the tensions between different UK stakeholders involved in the provision of institutional repositories of digital resources, in particular repositories of e-prints of peer-reviewed publications. Activists within the open access community have been arguing for the provision of free access to scholarly research publications. The open access movement has been successful in facilitating a wide public debate, in developing a range of technical solutions and in the promotion of the benefits across the academic community.

Many providers of institutional repositories envisage the authors depositing PDF versions of their papers in a repository: an approach which causes concerns regarding the accessibility of the resources. Suggestions that accessible HTML versions of papers should be provided have led to concerns that mandating HTML will place another hurdle in the way which can hinder the move towards greater access to the outputs of the research community. There is a conflict between those wishing to maximise open access by reducing barriers for authors wishing to deposit resources and those wishing to maximise access to resource for people with disabilities.

Our pragmatic user-focussed approach aims to address such tensions, within the context of the host institution. This would require institutions to develop policies and procedures which address issues including:

User engagement: Engaging with various stakeholders within the institution, including authors with disabilities, disability advisory bodies, etc.

Education: Development of an educational strategy to ensure that depositors of resources are made aware of accessibility issues and techniques for addressing such issues.

Monitoring: Monitoring tools used to create papers and formats used for depositing and prioritising training and technical developments based on popular tools.

Work flow evaluation: Evaluating work flow processes to ensure that accessibility features used are not discarded.

Technical innovation: Monitoring technical innovation which may help in making resources more accessible.

End user support: Development of policies for supporting users who may not be able to access resources.

Engagement with third party stakeholder: Identifying problems in publishers' templates and guidelines and making suggestions on improvements to ensure that papers based on such templates and guidelines will be more accessible.

Making use of third party services: The increasing development of third party Web 2.0 services can mean that such services may be able to provide richer accessibility than can be available by use of in-house applications. The Scribd service, for example, uses a text-to-speech converter to provide an audio transcript of documents uploaded to the service [38].

This approach is intended to avoid the scenario in which an organisation abandons plans to launch a repository which cannot be universally accessible, resulting in a situation which, ironically, is equally unavailable to everyone.

7.3 PAS 78 – Adopting Contextual Accessibility in a Standard

In March 2005, Publicly Available Specification 78: Guide to Good Practice in Commissioning Accessible Websites (PAS 78) was launched in the UK by the British Standards Institute [5]. It deviated from a typical 'standard' for Web accessibility in that it sought to promote a standard method of *procuring* accessible Web content, rather than designing accessible content. The standard emerged as a solution to the technical interpretation of accessibility guidelines experienced by those who were responsible for the establishment of a Web site, but without necessarily having the knowledge to:

- Specify a level of accessibility to be met, and
- Assess the delivered Web site for adherence to the specified level of accessibility.

While not related to the work described by the authors, the emergence of PAS 78 is relevant and of interest because:

- The nature of the document is such that it has to concentrate on a *process* that results in an optimally accessible Web site, rather than attempt to define a technically-testable level of accessibility.
- The document has a life-span of two years, after which point it is anticipated that a revised version will be necessary in order to update developments in Web, browsing and assistive technologies and formats, as well as emergence and maturation of relevant research and other standards.
- The nature of the document promotes and enables a contextual approach to be taken without mandating compliance with a specific technical standard, although it does strongly promote the merits of WCAG, UAAG and ATAG conformance, In this way, it encourages a more creative approach to choosing an appropriate accessibility strategy for the particular set of circumstances the reader faces.

The emergence of PAS 78 is therefore a complementary to the legislation of the UK's DDA, which concentrates on the obligations of employers, providers of "goods, facilities and services", and educational providers to take the necessary steps to avoid unjustifiable discrimination against disabled people; without mandating what 'reasonable steps' should be.

8. BUILDING ON THE CONTEXTUAL APPROACH

In February 2004 an Accessibility Summit was held in the UK which discussed the WAI guidelines and their applicability to the everyday activities of people preparing Web-based and electronic materials in UK higher education institutions. From this the holistic approach and later the Tangram model were developed in an attempt to describe the limitations of WCAG and to move towards the more user-focussed approach espoused in this paper. Indeed, several of the participants from the original Accessibility Summit later provided a response to the Draft WCAG 2.0 published by the W3C [29].

The second Accessibility Summit, held in November 2006, included a broader range of expertise and sectors. The discussions crystallised the common views of the participants and led to the creation of a manifesto to call on the public sector to rethink its approach to accessibility, utilising the WCAG as a part of a suite of approaches, rather than a standard with which to comply. The manifesto [26] suggests that accessibility guidelines should focus on the needs of the user and that technical guidelines should allow sufficient flexibility for approaches that are not necessarily guideline compliant to form part of a range of activities which, taken as a whole, form an accessible experience. It also recommends that users and stakeholders are consulted as part of the process of determination of accessibility in each context and that accessibility policy should be informed by research which as far as possible should allow for open access to data.

Future work in this area will involve the development of a roadmap, with a clear plan for future actions and identification of areas of disagreement for more research and specific action. This work will continue to discuss and develop trends in the international accessibility field and translate them into a meaningful approach to accessibility in the UK.

9. ACCESSIBILITY 2.0

We have described the holistic approach to e-learning accessibility and how this approach can be applied in a wider range of contexts, through use of the tangram metaphor and the contextualised stakeholder model, which provides a forum for discussion and debate across the stakeholder community. There still remains a need to be able to communicate the underlying philosophy with the wider community, including those involved in the development of accessibility guidelines, policy makers, accessibility organisations and government organisations.

The 'Accessibility 2.0' term aims to provide a means for articulating a shift in the approaches to addressing accessibility. This term builds on the wide penetration of the 'Web 2.0' term and related terms such as e-learning 2.0, library 2.0, etc. which aim to communicate a step change in approaches.

We can describe the characteristics of Accessibility 2.0 as:

User-focussed: As with Web 2.0, the emphasis is on the needs of the user. Accessibility 2.0 aims to address the needs of the user rather than compliance with guidelines.

Rich set of stakeholders: In contrast with traditional approaches to Web accessibility, which places an emphasis on the author of Web resources and, to a lesser extent, the end user, Accessibility 2.0 explicitly acknowledges that need to engage with a wider range of stakeholders.

Sustainability: Accessibility 2.0 emphasises the need for the sustainability of accessible services.

Always beta: There is an awareness that a finished perfect solution is not available; rather the process will be on ongoing refinement and development.

Flexibility: A good-enough solution will be preferred to the vision of a perfect technical solution.

Diversity: Recognition of the need for a diversity of solutions.

Blended, aggregated solutions: Users want solutions and services, but these need not necessarily be a single solution; nor need the solution be only an IT solution.

Accessibility as a bazaar, not a cathedral: The Cathedral and the Bazaar [28] analogy can be used to compare Accessibility 1.0 and 2.0. The WAI model is complex and developments are slow-moving in responding to rapid technological developments. The devolved approach of Accessibility 2.0 allows solutions to be deployed much more rapidly. These characteristics are summarised in **Table 1**.

Accessibility 1.0	Accessibility 2.0
Centralised	Devolved
Single solution	Variety of solutions
Slow moving / Inflexible	Rapid response/ Flexible
Remote testing	Testing in context
Hierarchical	Democratic
Idealistic	Pragmatic
Computer scientist's solution	Social scientist's solution
Focus on digital resources themselves	Focus on purpose of the resources
Technical debates (e.g. Semantic Web vs. Web 2.0)	Technnology-neutral
Popularity of automated testing tools (such as Bobby/Webxact)	Verification of policies and processes
End user and page authors as stakeholders	Rich variety of stakeholder communities
E-learning	Blended learning
Objective testing and verification	Subjective testing and verification
Medical model for disability	Social model for disability
Clear destination (WCAG AAA)	Focus on journey, not the destination
Accessibility as a thing	Accessibility as a process
Accessibility as a cathedral	Accessibility as a bazaar

Table 1: Characteristics of Accessibility 1.0 and Accessibility 2.0

10. IMPLICATIONS FOR WAI

This paper has highlighted deficiencies in the WAI approach to Web accessibility, but only in an effort to present a rationale for a new approach to accessibility of Web resources. It should be acknowledged that WAI has been extremely successful in raising an awareness of the importance of Web accessibility and in providing an initial model which has enabled providers of Web services to provide more accessible services. The lively debate on the future of the WAI guidelines reflects the interests of a wide range of communities in building on WAI's initial work.

Despite the problems with the current state of the WCAG guidelines, WCAG 2.0's technology-neutral approach, its foundation on the POUR (perceivable, operable, understandable, robust) general principles, the provision of *baselines* (which provide contextual solutions based on the end user's technical environment) and the recognition (in the related, non-normative techniques documents) that there can often be more than one solution for passing a success criterion, resonate with the ideas outlined in this paper. We would argue, however, that WAI can provide a more solid set of foundations on which to develop an environment for building more accessible Web services if the following issues are addressed:

Clarifying the WAI model: The WAI model is dependent not only on Web authoring implementing WCAG guidelines, but also software vendors providing UAAG-compliant user agents and ATAG-compliant authoring tools. In addition there is an implicit assumption that the organisations will deploy such tools and end users will make use of them. The evidence since the guidelines were released proves that such assumptions have not been reflected in reality. In the light of such evidence we suggest decoupling the 3-faceted WAI model, with WAI guidelines providing advice on best practices for Web authors, whilst the ATAG and UAAG guidelines provide advice aimed at software vendors. The WCAG guidelines should not, however, **require** adoption of tools which implement ATAG and UAAG guidelines.

Clarifying the role of context: The WCAG 1.0 guidelines do acknowledge the role of context in statements such as "Use W3C technologies when they are available and appropriate for a task …". A similar guideline stating "Use WCAG guidelines when they are appropriate for a task …" would be a simple way of recognizing that guidelines may not be applicable based on the context of use. This probably reflects the spirit of the guidelines, but this is not how the guidelines are often interpreted.

Acknowledgment that ultimate goal is accessibility for users:: The Web accessibility guidelines should explicitly state their limited scope in seeking to address the accessibility of Web resources, and that accessibility in a wider context could be achieved using non-Web solutions.

Acknowledging the relevance of diversity: WAI have always emphasised that compliance with WCAG guidelines need not lead to a uniform interface, and that CSS can be used to provide a diversity of user interfaces which can be accessible. With WCAG 2.0 guidelines being tolerant of a diversity of formats (including Flash and PDF, for example) there will be a need for the guidelines to restate the relevance of diversity in order to make a break with the approaches given in WCAG 1.0.

De-emphasing automated checking: Although WCAG guidelines do emphasise the importance of manual checking, in reality an industry has developed based on use of automated accessibility testing. There is therefore a need to re-evaluate the current approaches being taken and the effectiveness of WAI's outreach activities in this area. It is suggested that the tangram model may provide a useful educational device for demonstrating that automated testing addresses only a small part of the picture.

Refocussing of WAI's education and outreach activities: WAI's education and outreach activities will have an important role in ensuring that the diversity of stakeholders involved in the provision of accessible services have an understanding of the model which underpins the ideas described in this paper.

Engaging with a wider range of stakeholder: WAI's high profile places it in an ideal position to take on a coordinating role with other stakeholders in the development of a decentralised approach to maximising the accessibility, usability and interoperability of digital resources.

11. IMPLICATIONS FOR ACCESSIBILITY PRACTITIONERS

The work undertaken in developing these conceptual models needs to be translated into concrete outcomes, as highlighted by the second Accessibility Summit and discussed further at a Professional Forum on Accessibility 2.0 at the Museums and the Web 2007 conference [18] which explored the challenges in taking forward the contextual approaches within a museums context. These include:

- Research to produce accessibility-related evidence on which more informed design decisions can be made. Some such work has already taken place, although it has been argued that this has not impacted on the Web development community as much as it could have [34]. This might include evidence of,

for example, assistive technology uptake and usage, and attitudes to and awareness of browser capabilities.

- Developing and publicizing a body of best practice. Through case studies and other descriptions of successes – and failures – of how the Web has enhanced accessibility, this will reify what has until now been best practice that is only implied by appropriate interpretation of generic guidelines.
- There is also scope for standardising aspects of Web design with respect to accessibility, for example in the way that accessibility support and advice is provided to end users who need it most - particularly those for whom a gradual decline in sensory, physical or cognitive capability has led to an as yet undetected deterioration in browsing experience [35].
- Outreach to policymakers and the legal sector, such that contextual accessibility is incorporated appropriately in future policy, standards and legislation. The publication of PAS 78 in the UK has shown that this is possible; success in terms of adoption of PAS 78 remains to be seen.

As we move to a more context-driven, process-driven approach to Web accessibility, we anticipate other issues emerging, which will require attention by researchers and practitioners alike. This in turn will lead, we hope, to a better understanding of how the Web can be used to its full potential as an enabling technology.

12. CONCLUSIONS

It is clear that current approaches to accessibility must adapt in order to respond to changes in the way Web content is created, provided and accessed. In particular, challenges include the increasingly diverse sources of Web content, and the role the Web plays in a wider context of information, service and experience delivery. There will remain, of course, an important role for technical guidance on what constitutes best practice in accessible Web design. It is equally important that approaches should help to identify where a 'one size fits all' approach may be impractical or inappropriate, and should encourage and support creativity in providing multiple, aggregated routes that together help as many as possible achieve the same end goal.

What we have termed 'Accessibility 2.0' is therefore about codifying best practice in taking whatever steps are reasonable and necessary to ensure that the Web can be used to its potential of enabling access to information, services and experiences regardless of disability. This means creating a framework where technical guidance WCAG 1.0, and potentially WCAG 2.0, has a valid and valuable role to play within a wider context, and encouraging defining context such that it can positively influence the design approach taken. A combination of the Tangram metaphor and Stakeholder model forms an important basis on which a more informed, appropriate approach to accessibility can be taken; it also points us in the direction of current and future activities necessary to continue the development of the Web as a way in which social exclusion can be minimised.

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